Scenario analysis in foresight: AG2020

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Abstract
Complexity and uncertainty are key issues in exploring future developments. Moreover, although the future cannot be predicted, it is clear that certain decisions/actions can influence the future in desired directions. In this respect, planners are being challenged to focus on the development of new approaches and tools, capable of dealing with complexity and uncertainty, in order to be able to effectively support policy makers in making more knowledgeable decisions to achieve desirable future outcomes. The *focus* of the present paper is on the development of such an approach, i.e. a backcasting policy-scenario design approach, used for the study of the future developments in EU agriculture in 2020. In this respect, the paper presents the main stream of methodological approaches for scenario building, i.e. forecasting and backcasting approaches; it elaborates on the steps involved in the backcasting policy-scenario design framework; and it follows these steps by adopting the backcasting policy-scenario design framework in the AG2020 EU project on the future of EU agriculture in 2020[1].

[1] AG2020 - Foresight Analysis for World Agricultural Markets in Europe 2020, Contract no.: 44280-AG2020, STREP, 2007-2009

1. Introduction

In dealing with complexity and uncertainty, traditional tools have serious drawbacks, mainly emerging from their inherent deterministic rationale. These drawbacks have mobilized many research efforts towards more effective approaches in dealing with the complexity and uncertainty involved in the study of the long-term developments of the various systems under consideration. The focus of such approaches is on the adoption of appropriate tools, such as scenario analysis, participatory approaches for the involvement of the public in decision making, etc. This reflects the remarkable shift, in the research community, from the view that "the future is there to be predicted" to the view that "the future is to be created by society", where its systematic study forms the basis for "choosing and creating the most desirable future outcome" (STRATA-ETAN, 2002).

Moreover, as certain decisions/actions can influence future developments towards more desirable outcomes, it is becoming increasingly important for policy makers to grasp the potential impacts of various policy decisions on the formation of the desired outcome, and thus arrive at knowledgeable policy decisions.

The focus of the present paper is on the design of a backcasting policy scenario methodology, adopted in the AG2020 EU project for exploring future developments and guiding policy options in EU agriculture in 2020. In this respect, Section 2 presents the main streams of methodological approaches used for scenario building; Section 3 elaborates on the stages involved in the design of the backcasting policy scenario approach, while Section 4 concentrates on the application of the backcasting policy scenario approach in the AG2020 project on the future of EU agriculture in 2020. Finally, in Section 5 some conclusions are drawn.

2. Methodological Approaches for Scenario Building

Various definitions of 'scenarios' can be found in the literature (see, for example, Porter, 1985; Schwartz, 1991; Shoemaker, 1995; Ringland, 1998; van Notten, 2005). According to Bradfield (2004): "… there is a large number of different and sometimes conflicting definitions, characteristics, principles and methodological approaches about scenarios. All definitions, though, converge in that scenarios are not forecasts or predictions of future developments, but rather descriptions of how the future might unfold, mapping out the 'possibility space' of future developments".

Scenarios are often regarded as useful tools for gathering intelligence on future developments. The most distinctive contributions of scenarios in future studies originate from:

- facilitation of increasing *transparency* of societal and political choices;
- provision of *new insights* into possible policy paths by answering 'what if' questions;
- provision of a *frame of reference* for evaluations and judgments through impact assessment of potential future developments;
- usefulness as *communicative tools*, conveying messages and increasing awareness of various social groups in a participatory context;
- stimulation of *stakeholders' engagement* in the process of change;

- stimulation of *interaction* and *creative thinking* among policy makers, stakeholders and the public;
- potential to effectively organize a variety of seemingly unrelated *economic, technological, political and social information* and translate all this into a coherent framework for judgment.

Scenarios are powerful tools in modern policy analysis, in both the private and the public domains. Unlike other deterministic, stochastic or blueprint planning techniques for short to medium-term policy issues, scenarios are operational tools for complex decision making that is marked by long-term and largely unpredictable uncertainty, where the visioning of future developments is desirable for guiding the policy agenda. They can also be used as "learning" tools that do not aim to identify the best possible future, but to design a rational and transparent mechanism for coping with uncertain futures.

Two *scenario building methodological approaches* are discussed below. which represent the most prevailing streams of today: namely, the forecasting and backcasting approaches. These can be further enriched by participatory approaches as valuable communicative and learning tools in the hands of planners and decision makers. Participatory scenarios enable them to communicate new ideas, but also to gather knowledge from experts and stakeholders, thus providing better insight into the problem at hand by checking the acceptability of the proposed solutions.

Forecasting scenarios are defined as exploratory/descriptive scenarios, based on a forward-looking approach to the future. The key hypothesis in building forecasting scenarios is that the future represents a logical extension of past and present developments, where, based on extrapolations of past and present trends, a range of probable futures can be drawn.

Backcasting scenarios, on the other hand, are normative/prescriptive scenarios, based on a backward-looking approach, where "*…the focus is not on what futures are likely to happen, but on how desirable futures can be attained"* (Robinson, 1990). They thus involve working backwards from a particular desirable future end-point to the present in order to determine the feasibility of that future and the policy action required to reach that point. They are built by means of norms and values of stakeholders or respondents. They typically aim to provide policy makers and an interested general public with images of the future as a background for opinion-forming and policy decisions (Dreborg, 1996). Usually, backcasting scenarios are issue- or problem-driven scenarios, in which images of the future incorporate desirable solutions to major problems.

The *nature* of the problem concerned and the *time horizon* involved largely defines the choice of the scenario approach to be adopted. Forecasting scenario approaches are more appropriate in *short- term studies*, while the backcasting scenario approaches are better for medium to long-term horizons. Within a short-term horizon, the system under study is normally not subjected to radical changes. This implies that past behaviour may, to a large extent, explain its evolution. Quantitative data, in this respect, as well as deterministic and quantitative models, deal rather effectively with the system concerned and the future can, to a large extent, be predicted on the basis of

its past behaviour, or in the words of Lindgren and Bandhold (2003): "… the future will be".

On the other hand, in *medium to long-term future studies*, where a high level of uncertainty is involved, forecasting approaches are no longer relevant, as the future appears multiple and uncertain. The more distant the time horizon, the higher the uncertainty and the potential discontinuities involved. Completely different future structures may emerge in this context due to, for example, a paradigm shift or non-linear changes, or in the words of Lindgren and Bandhold (2003): "…the future is created". Backcasting is relevant in such kinds of future studies.

The time dimension also defines to a large extent the *type of data* used in the scenario analysis (quantitative or qualitative), the *tools* used for processing these data, the level of *uncertainty* involved in the approach, the *type* of the future involved (probable, possible, or desired), the need for *strategic thinking*, etc. (Giaoutzi and Stratigea, 2007, 2010).

Table 1 below presents the key differences between the forecasting and the backcasting scenario approaches in terms of their starting point, focus, process, and outcome of the scenario building experiment.

Table 1: From forecasting to backcasting scenarios

Approach / *Issue*	*>From Forecasting*	*To Backcasting*
Starting point	Reactive, problem-driven	Proactive, vision-driven
	>From present to future	>From future to present
	Model-determined mindset	Alertness to signals of uncertainty
Focus	Focus on quantified variables	Focus on qualitative pictures
	More emphasis on details	More emphasis on trends
	Deterministic analysis	Creative thinking
	Single-track thinking	Multi-track thinking
	Prediction and likelihood	Feasibility and choice
Process	>From simple to complex	>From complex to simple
	>From quantitative to qualitative	>From qualitative to quantitative
	Statistical-econometric tests	Plausible reasoning
	Multiple implicit assumptions	Transparent (simple) assumptions
Results	Results determined by status quo	Results based on future images
	Closed future	Open future
	Limited set of options	Open range of options

Currently, an important aspect in building backcasting scenarios is associated with the issue of *participation*. Participatory approaches are quite important at the various stages of the planning process, as they can reveal the prevailing priorities in each specific social context (Stratigea, 2010). Moreover, they can serve as ownership- and consensus-building tools, by driving structured processes of interaction among varying stakeholders' interests, thus reaching mutually satisfying solutions (Creighton et al., 1998). Involving participation in the process of building backcasting scenarios supports the identification of issues that truly matter, strengthens the content of the analysis, and builds ownership of findings among audiences, who are supposed to

follow up with action. Moreover, participatory scenario building approaches can be used to build a common vision among participants.

3. The Backcasting Scenario Design Process

3.1 Introduction

This section presents the steps of the backcasting policy scenario design process. The whole process consists of two elements: namely, the *explorative element*, in which different developments are explored in relation to the system under study (internal environment), but also other external factors (external environment); and the *backcasting element*, in which, for each different development, possible solutions to the problems posed for the system under study have to be sought.

The *explorative element* consists of the following two steps (Giaoutzi et al., 2008a):
Step 1 refers to the identification and prioritization of problems, which guide the selection of objectives and targets. More specifically, it includes the following stages:

- Regionalization stage (spatial delimitation of the study system);
- Identification/prioritization of problems, in both the internal (study system) and the external environment;
- Selection of objectives, policy targets and the respective indicators.

Step 2 refers to the structuring of the baseline scenario as follows:

- Study of the present situation various attributes of the region concerned, e.g. environmental, social, economic, etc.;
- Identification of trends: (based on past and present developments);
- Calculation of a baseline scenario and exploration of the need for backcasting, trends projected to a certain time horizon, while next the *gap* identified between projected and desired outcomes is explored.

The *backcasting element* consists of the following two steps (Giaoutzi et al., 2008a):
Step 3: Design of Images of the Future.
Step 4: Involves the:

- Selection of policy measures
- Structuring of policy packages as sets of policy measures
- Construction of paths (trajectories) as policy frameworks, leading from the present state to Images of the Future.

These four steps of the backcasting policy-scenario design process will be briefly presented in the following subsections.

3.2 The explorative element

The steps involved in the explorative element of the backcasting policy-scenario design process include:

Regionalization stage
The study area is defined on the basis of various regionalization criteria, which serve the goal pursued by a certain study.

Identification/prioritization of problems
Identification and prioritization of problems relating to both the internal environment and the external environment (external factors) of the study system.

Selection of objectives, policy targets, and indicators
In this stage the objectives, the policy targets and the respective indicators are defined as well, which lead to the fulfilment of the goal (Giaoutzi et al., 2007a; Giaoutzi and Stratigea, 2007a). Policy targets provide direction for policy measures, packages and paths, but also support the construction of Images of the Future, built in the backcasting element of the process that follows.

Study of the present situation
The present situation of the study system sheds light on both the general aspects of the study region, e.g. environmental, but also on specific aspects of the selected goal (e.g. development in agriculture).

Identification of trends
On the basis of the past and present behaviour of the study system certain trends can be identified. Key drivers of change in both the *external* and *internal environment* need to be discussed in this respect, since they reveal future challenges for policy making (Giaoutzi and Stratigea, 2007b, Giaoutzi et al., 2008b).

Calculation of a baseline scenario – Exploring the need for backcasting
The baseline scenario is not meant to be a likely scenario: it shows what the system concerned would look like at a certain time horizon, if no additional policies are implemented (Banse et al., 2008). A baseline scenario is necessary to measure the *level of change* that is needed in pursuing a desired future. Data from today can be projected into the future (target year of the study) in a business-as-usual scenario (BAU), where no trends have been broken. This makes it possible to calculate the *gap* between 'business-as-usual' and the scenarios fulfilling the targets, thus indicating where trend breaking is needed. A baseline scenario is therefore necessary as a point of reference in order to evaluate the performance of the different scenarios with respect to the targets set. Moreover, it can reveal the political commitment that will be needed over time to close the gap between the baseline scenario and a desired, target-driven, future.

3.3 The Backcasting Element
Backcasting was introduced by Robinson (1982) as a particular kind of scenario design approach, where scenarios are chosen to reflect desirable developments. Backcasting scenarios are of special interest in cases where long-term solutions to major societal problems are sought, or when policy making involves substantial change (POSSUM, 1998). Within the backcasting element of key importance is the structuring of Images of the Future; and the design of policy packages and paths that may drive the system under study from the present situation towards a desired, target-driven, Image of the Future (see Figure 1).

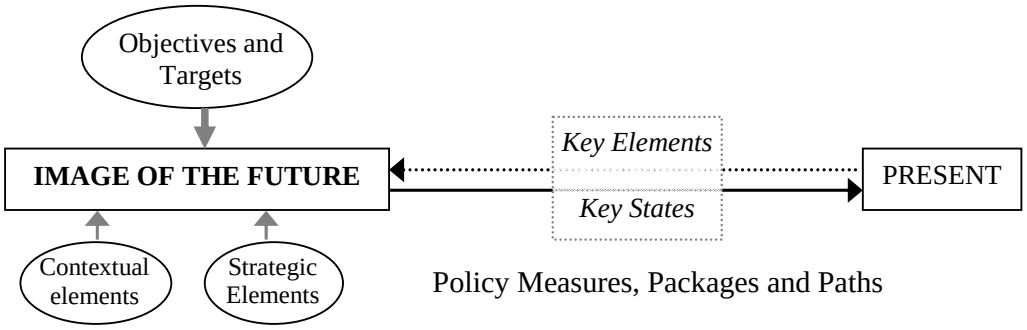

Figure 1: The backcasting process
Source:POSSUM (1998)

Generally, in a backcasting scenario experiment, the following backcasting components have to be determined (POSSUM, 1998) (see Figure 3-1):

- Objectives and targets to be met by the end of the relevant time horizon;
- A set of important contextual factors (external factors);
- The main strategic elements associated with each scenario;
- The Images of the Future;
- The key elements and key states; and
- The policy measures, packages and paths used to achieve a transition from the present situation to a desirable future image.

These elements are briefly presented below.

Objectives and policy targets
These were already defined in the explorative element of the backcasting scenario design process (see Subsection 3.2 above).

Contextual elements
These refer to external developments in society that can potentially be used in the backcasting framework, defining the future decision environment, within which policy decisions are made.

Strategic elements
These elements are considered as key drivers to steer changes, in the study system, towards the achievement of targets within different decision environments (Giaoutzi and Stratigea, 2007b).

Images of the Future
Images of the Future describe society and the policy-making environment at a specific target time horizon, and form the framework for identifying suitable policy measures, packages and paths to reach the policy targets. The design of Images has to take into account the following principles (see POSSUM, 1998; Banister and Hickman, 2005):

- Images should fulfil the targets, set in the backcasting exercise;
- Each Image should be plausible, but could also be relatively extreme;

- Images should be clearly different from each other in order to give an idea of the range of possible distinct futures;
- mages should cover a sufficiently wide range of future possible outcomes;
- To keep the research manageable, only a small number of images have to be selected.

The *building blocks* of the Images of the Future are (see Figure 1 above):
- Objectives and targets set for the study system at hand;
- Contextual elements; and,
- Strategic elements.

Different combinations of the contextual and strategic elements lead to the construction of *Images of the Future* (Figure 1 above). These describe different states (developments) of the society and the study system placed within a certain time horizon, and *the decision environments*, within which targets set at previous stages are pursued on the basis of different combinations of the strategic elements (Giaoutzi and Stratigea, 2007b).

From a theoretical point of view, a large number of possible Images of the Future may be constructed. However, certain combinations of contextual and strategic elements can lead to the creation of Images which are not feasible or lack consistency. At the stage of selecting Images of the Future, already well-documented choices about future developments can limit this number to several distinct Images of the Future, which present discrete future outcomes.

Key elements and key states

Key elements refer to broad areas of change that are required in order to achieve the targets set within a specific time horizon. They address the type of policy measures that need to be in place in pursuing the achievement of targets.

The *key states*, on the other hand, refer to the level of change required to achieve the targets in the backcasting context. They can also indicate intermediate goals in order to meet the pursued targets, thus acting as intermediate steps between the present state and Images of the Future, and guiding the identification of policy measures and the structuring of policy packages and paths relevant for reaching the desired ends within the Images (see Figure 1 above).

The key states are linked to the key elements involved in each image, focusing, at the same time, on the main assumptions concerning each key element in the Images (see Giaoutzi and Stratigea, 2010, AG2020, D5.5). Key states, in this respect, are indicative rather than prescriptive tools for identifying the *gap* between the baseline scenario and Images. For bridging this gap, different combinations of policy packages and measures should be addressed, based on their potential to affect changes in key elements, leading towards the desired end.

Policy measures, packages and paths

When the Images of the Future have been defined, the next step is to think about possible policy measures, packages and paths that can drive developments to desired ends, i.e. from the present situation to future images. This involves the development of a policy framework (e.g. a new CAP framework), and the identification of the role of decision makers, the private sector, consumers, and other stakeholders in policy development and implementation.

The backcasting process provides the basis for identifying *policy measures, packages, and paths* that are compatible with both the Images of the Future and the policy targets. It includes a consideration of timelines, policy priorities, intermediate goals, and the potential of different policy instruments to achieve the targets. The policy measures, paths and packages can be developed using a combination of a *deductive approach* and an *inductive approach*, where:

- the *deductive approach* is based on the framework of the constructed images that are serving as a basis for the definition of the outline of the packages and paths; and
- the *inductive - intuitive approach* starts from a list of policy measures, and continues by enabling a creative process of inventing new combinations of policies.

The first step at this stage is the selection of a comprehensive list of *policy measures* (see Figure 2). These are defined on the basis of their potential to influence the key elements of the system concerned, thus contributing to the achievement of the targets set for the study region/problem concerned.

In addition, *policy packages* are developed by combining sets of policy measures that are likely to work well together (i.e. create synergies) (Figure 2). Policy packages are well-structured combinations of measures with foreseeable implications; form sets of measures to be introduced for discussion with decision makers; address a specific issue; provide a convincing contribution to the solution of a problem; have a balanced impact on the various groups of stakeholders concerned; and are designed to address a specific dimension in the Images of the Future.

In practical politics, for the structuring of a policy package, it is useful to start from a triggering issue, use a central policy measure, and add complementary policy measures, so as to form a balanced package, which is not too large and has an inner construction logic. New or modified kinds of policy measures are likely to be proposed in this process. The conceptual backcasting framework can then be used for a more systematic appraisal of this package, which may again lead to adjustments.The construction of policy packages has been one of the most important steps in the backcasting process, since it facilitates (Giaoutzi and Stratigea, 2010):

- focused discussions, producing results within a limited time frame; and
- intuitive creativity, enabling the development of new perspectives based on a specific participatory framework.

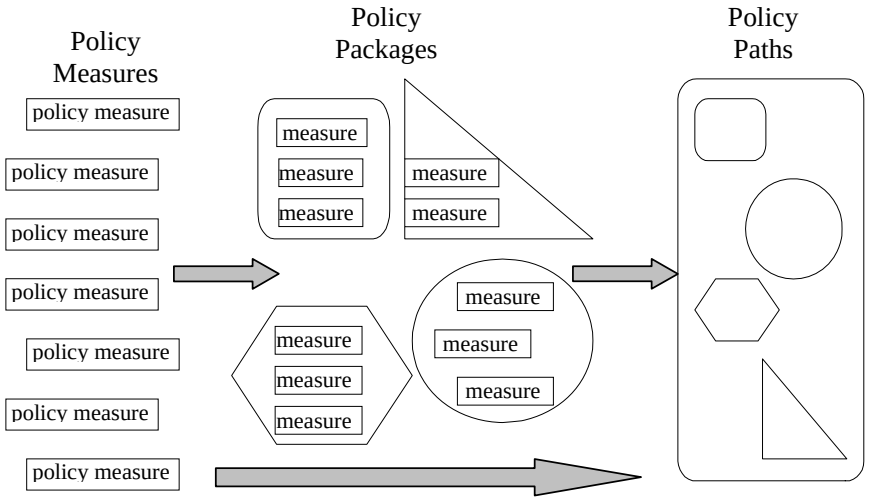

Figure 2: Methodological approach for the construction of policy packages and paths
Source: POSSUM (1998)

Finally, *policy paths* in a backcasting framework result as combinations of policy packages, i.e. a policy path is made up of both policy packages and policy measures (Figure 2). Paths actually contain a large number of policy measures necessary to attain the targets set in the Images. The construction of policy packages and policy paths is an iterative process, which could go on over many cycles. Policy paths are designed to drive developments from the present to the Images of the Future. There are a number of policy paths that can serve this purpose. Which path will be followed is largely dependent upon the specific regional context, i.e. social values, views, culture, etc.

As backcasting is relevant when trend breaking is needed, it is necessary to assess the role of the different policy measures, packages and paths in 'bridging' the gap between the targets set and the baseline scenario. Moreover, the participatory element is of importance at this stage, as social awareness is necessary for the effectiveness of the proposed policies.

Backcasting policy scenarios
The outcome of the backcasting policy-scenario design process is a *set of backcasting policy scenarios*. In the backcasting context, the term *policy scenario* incorporates both the Images of the Future and the trajectory (policy path) leading from the present to a specific Image (Banister and Hickman, 2005; Banister et al., 2006).

4. Building Backcasting Strategic Policy Scenarios for EU Agriculture 2020

This section presents the application of the backcasting policy-scenario design framework in the context of the AG2020 EU project. The aim of this application is to explore the future developments of EU agriculture in 2020. The goal of the AG2020 project is to improve decision making and enhance the resilience of the Common EU

Agricultural Policy (CAP) reforms by synthesizing a range of policy scenarios for the year 2020, based on various quantitative and qualitative analyses.

To this end, the AG2020 project consists of two important parts:
The *first part* refers to the *foresight process*, in which the current and expected future situation of the European agricultural sector and rural areas is explored. Combined with the outcome of participatory approaches, this results in the identification of trends and influential factors, the 'key drivers' of change for the future of agricultural Europe.
The *second part* elaborates on the *strategic policy-scenario framework* (the backcasting element). In this part, sustainability targets together with the key drivers of change, are used to develop strategic policy scenarios that meet the EU objectives. This requires the development of plausible and desirable 'Images of the Future' for agriculture in Europe 2020 and related policy packages and paths that enable the targets to be reached.

There are numerous ways to build scenarios as a means to clarify policy options. As mentioned, for the AG2020 project, the backcasting policy-scenario approach is adopted, i.e. a set of desired futures (Images of the Future) is selected on the basis of certain criteria for the time horizon considered (2020). These Images provide the background against which policy decisions for reaching the targets set can be made. Backcasting policy scenarios are then described by the Images of the Future, i.e. the 2020 snapshots and the policy paths, namely, the sets of policy measures and policy packages that are capable of driving developments from the present state up to future images (see Figure 1 above).
We will now present the various stages of the backcasting policy-scenario design approach, as applied in AG2020.

Regionalization stage
In AG2020, the study area explored is the whole region of the EU. In addition, a set of representative 'case study' regions is selected in order to obtain more insight into the regional specificities of the agricultural sector across the EU. The case studies were selected on the basis of certain selection criteria, such as the level of development, geographic position, morphological characteristics, relevance to the AG2020 context, etc. The role of these case studies is to enrich both the problem identification stage in AG2020, based on the study of a variety of EU agricultural contexts, and the range of policy tools for driving the development of the EU agricultural sector in 2020. The AG2020 regionalization approach reflects the need to integrate bottom-up and top-down approaches.

Identification/prioritization of problems
In this step problems/issues are identified in the context of AG2020 that refer to both the *internal environment* of the study system, i.e. the EU agricultural system, and the *external environment*, i.e. other issues that can influence developments in the EU agricultural system. Based on that, key elements are identified, which can refer to both the internal and the external environment.
The key elements of the *internal environment* are considered as endogenous drivers of the EU agricultural system, and are largely affected not only by the EU agricultural policy (CAP reform), but also by EU policies in other fields, e.g. environmental policies, trade policies, energy policies, etc., which strongly condition the

development patterns of the agricultural sector. These are determined on the basis of consistent reasoning of the AG2020 team and are validated by external experts at a later stage, both inside and outside the AG2020 project. It should also be noted that the knowledge of the key elements of the internal environment is used, at a later stage, to support the choice of those strategic elements that are considered the most influential drivers of the EU agricultural system**.**

In AG2020 the following elements of the *internal environment* were considered:

- The agricultural production system as such (different sectors of agricultural production, efficiency issues, supply versus demand in agriculture, etc.);
- The social system that supports agricultural production (demography/migration patterns, labour force skills, attitude to ICTs, etc.); and
- The natural resources upon which the agricultural activity is based (land availability, land-use conflicts, water resources, etc.).

The elements of the *external environment* are those elements, external to the EU agricultural system, which are expected to have an impact on the system in the long run. These elements are considered to be exogenous drivers of the EU agricultural system, in the sense that they are not directly influenced by the EU agri-policies. The *external elements* in AG2020 were further divided into (Giaoutzi and Stratigea, 2007b):

- *Market-related elements* that refer to agricultural developments or policies outside the EU agricultural sector (WTO policies / world agricultural markets, economic growth, etc.); and
- *Non-market-related elements,* such as environmental issues (e.g. climate change, rise of sea level), depletion of resources (water - land scarcity), social change and lifestyles, demographic developments, science and technology, education/training, macroeconomic growth**,** consumer preferences and respective consumption patterns, energy production aspects (growing interest in biofuels production and its impact on the agri-food sector),etc.

It should be noted, however that the distinction between the elements of the internal and the external environment is not always quite clear, as the line is not very easy to draw (Giaoutzi and Stratigea, 2007b). For example, biofuels production can be considered as an element of the external environment, expressing the global shift towards renewable energy production, but can also be considered as an element of the agricultural system per se by means of energy crops for biofuels production. Nevertheless, a clear decision has to be made as to whether an element is external or internal to the study system at an early stage, and to keep it consistently throughout the whole scenario building exercise.

Selection of objectives and policy targets

At this stage, the objectives serving the goal of AG2020 (sustainable development of EU agriculture) are selected, taking into account the output of the previous stages. On the base of these objectives, a set of policy targets is defined, which are further translated into indicators that serve the purpose of assessing, at a later stage, the performance of policy scenarios with respect to the targets set.

In pursuing sustainability in the EU agricultural sector, AG2020 is focusing on the following objectives (Giaoutzi et al., 2007a, 2007b):

- *Environmental objective*: introducing the need to preserve the ecological balance of physical and biological systems, for present and future generations;
- *Economic efficiency objective*: "… attaining the maximum flow of income that can be created, while at least maintaining the non-renewable stocks or assets that yield these benefits" (Stimson et al., 2006, p.40);
- *Regional development objective*: aiming to reduce disparities in rural areas and to ensure equal access to employment, services, etc.;
- *Social cohesion objective*: aspiring to maintain the stability of social and cultural systems, by pursuing a healthy and productive life in harmony with the natural and cultural environment;
- *Food quality and safety objective*: aiming to support high-quality and safe food production, as well as trust of agri-food products for consumers, an issue that is expected to continue to receive attention in both industrialized and less developed countries (Unnevehr and Roberts, 2003); and
- *Energy objective*: aiming at contributing to the EU climate change policy target of a 20 per cent reduction in GHG emissions compared to 1990. Towards this end, the EU has planned its long-term energy policy up to 2020, within which the agricultural sector can play a crucial role, both as a consumer (less energy-consuming sector) and a producer of energy (e.g. biomass but also energy crops).

As a next step, potential *policy targets* in AG2020 are selected. Towards this end, a combination of a top-down and a bottom-up approach is used, serving convergence, validation, and checking purposes.
The *'top-down'* approach represents a deductive, comprehensive and systematic strategy, using a framework where targets are derived from principles, objectives, sectors, issues and causal relationships (POSSUM, 1998; Banister et al., 2000). The *'bottom-up'* approach is an inductive, knowledge-based strategy, involving a review of the existing targets of sustainable development from the literature as well as a review of the sustainability targets in the study context (agri-sector). The combination of the 'top-down' and 'bottom-up' approaches makes it possible to check that all key issues are considered. This leads to the selection of a comprehensive set of potential targets, which are further evaluated on the basis of certain selection criteria, e.g. scientific validation, the representativeness of a broad range of conditions, responsiveness to change, relevance to the needs of potential users, policy relevance, measurability, etc. (Maclaren, 1996; COM(2001)144 final; Giaoutzi and Stratigea, 2007a; Giaoutzi et al., 2008b).

More specifically, the identification of policy targets in AG2020 is based on the following four separate complementary approaches (Giaoutzi and Stratigea, 2007a) (Figure 3):
- Expert workshops;
- Internal AG2020 workshops;
- Literature review; and
- Review of sustainability targets.

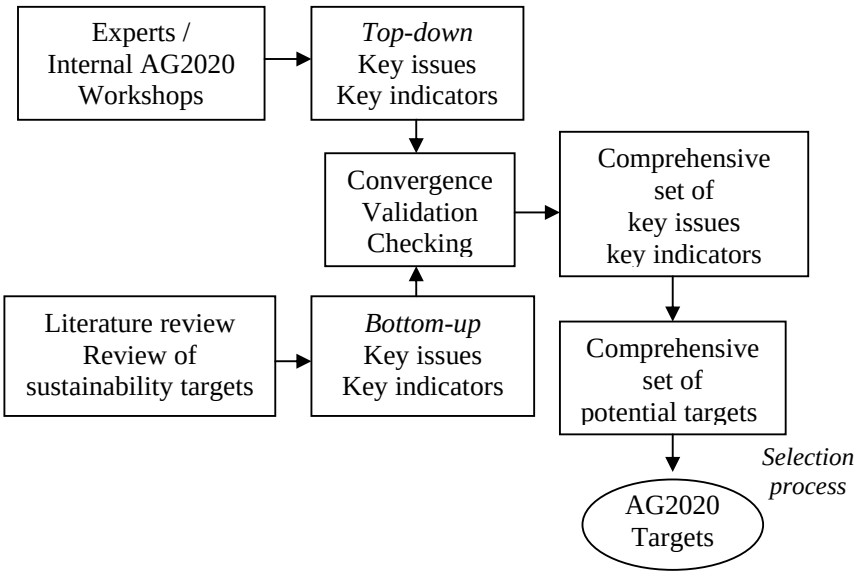

Figure 3: Selection process for defining policy targets in AG2020
Source: POSSUM (1998); Giaoutzi and Stratigea (2007a).

The AG2020 targets selected out of this process are presented in Table 2 below.

Study of the present situation
This section concentrates on the agricultural sector in the EU. In order to enable the identification and mapping of the emerging patterns in the sector, it has been divided into the crops, livestock and forestry sub-sectors. Moreover, taken into account in the study of the present situation are developments in the external environment, such as rapid technological changes in biotechnology, nanotechnology etc., demographic developments, migration patterns, social developments, etc.

Identification of trends
The identification of trends is an important part of the backcasting scenario design approach, as it focuses on the dynamics of the system under study and its relationship to the rest of the economic sectors. In AG2020, trends were examined in the following fields, at both a European and a global level (for more details, see Giaoutzi et al., 2008b):

- Environmental trends
- Market trends
- Demographic and migration trends
- Patterns of agricultural production
- Regional development trends
- Food safety and quality trends
- Energy production trends
- Public participation trends.

Table 2: Targets pursued in AG2020

OBJECTIVES	TARGETS	EU Target Year 2020	AG2020 Targets	Source
Environment	GHG Emissions (in CO_2 equiv.)	20% decrease of GHG emissions by 2020 compared with 1990 emissions	Decrease of N_2O, CH_4 emissions from agriculture in CO_2 equivalents	EU
	Biodiversity	Halt loss of biodiversity (Set in 2001 for 2010)	Halting the loss of biodiversity by 2020 – High rate of halting	EU Council of the European Union, 2004; EURURALIS
Economic efficiency	Competitive-ness / Efficiency	Economically-viable regions	Strong competitiveness / efficiency in the agri-food sector	EU – Lisbon Agenda
Regional development	Multifunc-tionality	Increase level of multifunctionality	Multifunctionality of rural regions – High level	EU
Food quality and safety	Food and feed traceability	Traceability of feed and food	Food and feed traceability – High rate	EU
Energy production	Bio-based economy	Blending targets: in transportation fuel 10% of biofuels (2020)	Blending targets: in - transportation fuel 10% of biofuels (2020) - electricity 7% (2020) - chemicals 10% (2020)	EU

Calculation of a baseline scenario – exploration of the need for backcasting

The main aim of the baseline scenario is to provide insights into the consequences of a baseline projection, assuming that current policies in the field of agriculture will remain unchanged until 2020. The focus in the AG2020 approach is on the development of supply, demand and trade on agri-food markets, as well as on the interaction of the agricultural sector with the rest of the economic sectors and its contribution to the EU economy. It also addresses certain environmental issues that are central to current European policies.

Towards this end, the baseline projection is built upon the development of an integrated modelling framework (Banse et al., 2008), consisting of: an economy-wide General Equilibrium (GE) model (LEITAP), which is linked to IMAGE, a spatial land-use model; and a set of Partial Equilibrium (PE) models, focusing on agri-food markets in the EU at the national level (ESIM model), the regional level (CAPRI model), and various regions outside the EU (IMPACT model). This modelling framework takes into account the main drivers, trends and factors for the overall economy and for the agricultural sector as well. In addition, the framework allows for analysis at the NUTS2 level for the EU Member States and for the EU-27 as a whole.

The baseline projection has revealed that the policy targets set in AG2020 are not going to be met by 2020 (Banse et al., 2008). This implies the need for political commitment over the coming years in an effort to close the gap between the projected and desired target-driven outcomes.

Contextual (external) elements

The rationale for building AG2020 Images of the Future should be reflected, as a first step, in the terms of the hypotheses used relating to the contextual setting. These are the levels of 'cooperation' and/or 'polarization', considered as core features for the structuring of the Images of the Future. The concepts of 'cooperation' and 'polarization' essentially pertain to the way society copes with market failure and public goods and bads. Here, agreements and common policies besides the market are often needed. The climate for 'cooperation' is then of crucial importance. Is there a spirit of 'cooperation' and social responsibility or is free-riding the dominant behaviour? Do people act like citizens or like self-interested profit maximizers? The answers to these questions will affect what policies are possible and suitable, and what targets can be achieved.

Moreover, many environmental problems are related to social dilemmas. The attitudes towards cooperation in such situations is crucial for solving the problems concerned. Here, different assumptions are made in the different Images of the Future. One contextual element that can also be listed is the spreading of an international lifestyle, where people increasingly travel to exotic places ('dominant international lifestyle'). At the same time, however, some groups of people exhibit a more 'local' lifestyle, by means of tasting locally produced goods and services, as well as exploring their own native district. The relative strength of these two lifestyles in the future will have a strong impact on the demand for agricultural products.

Another potentially important factor in the description of the contextual elements is the rate and level of spreading green values. Is the emerging 'green' consciousness more or less a fad or a profound shift in our view of man's relation to nature and nature's degree of resilience to perturbations?

In addition to the above aspects, there are also a number of other issues that have to be addressed in the design process of the Images of the Future. Such issues are, for example, innovations and niche markets; regional development and innovation; economic efficiency in the agricultural sector; critical issues in the development of the European agricultural sector.

In AG2020, three contextual alternatives are distinguished, which combine the various elements mentioned above, namely (Giaoutzi et al., 2008b):

- *Bilateral and EU cooperation ('top-down' politics)*: cooperation among global players is important, with free trade and a striving for consensus on environmental issues. At the local and regional levels, the attitudes towards cooperation are more passive, as the political agenda is mainly driven by national and EU politicians. The focus is more on high-level problems. Politicians take the lead and try to influence opinion.
- *Local - Multilateral cooperation ('combined'):* all regions and nations in the world are able to participate. It promotes an accord between local, regional and supranational initiatives and objectives, a kind of harmony between 'bottom-up' and 'top-down' politics. Green values are widespread, with both local and international lifestyles.
- *Local, Regional and EU cooperation ('bottom-up' politics)*: policies are mainly driven by local and regional initiatives. Local and regional aspects are high on the political agenda, while global environmental issues are a little lower down. Green

values are pushed by ‘grassroots’ movements rather than by national or EU politicians, who lag behind but do try to meet popular demand. There is polarization at the global level, where EU the US and Japan take different stands on questions such as global warming, and tend to protect their own markets against competition from outside.

Strategic elements

This part elaborates on the strategic elements used in the AG2020 backcasting policy scenario approach. Technology and decoupling were considered to be such aspects.

Technology is an important element for supporting sustainable development in EU agriculture. It is now facing many challenges due to globalization, energy shortage, and climate change. Moreover, it is also important for Europe’s farming, agri-food and forestry sectors, which, by means of technological innovations, can further develop high quality and value-added products that meet the diverse and growing demand of consumers in European and world markets [COM(2005)304]. In AG2020, technologies are considered in terms of their relevance both for the agricultural sector, e.g. technologies relating to primary production and processing, and for other fields/sectors in rural regions, e.g. organization of firms, teleworking, service sector etc. (for more details, see Giaoutzi and Stratigea, 2010). As far as *decoupling* is concerned, the following streams of decoupling are considered to be of relevance in AG2020 (Giaoutzi and Stratigea, 2010):

- Decoupling agricultural production from environmental impacts;
- Decoupling agricultural production from intensive use of resources (less resource-intensive agri-production);
- Decoupling rural development from the agricultural sector;
- Decoupling agricultural income (direct payments) from the volume of agri-food production;
- Decoupling the growth of GDP from the volume of agricultural production;
- Decoupling the price of agri-food products from food quality and safety;
- Decoupling agri-food production from bio-energy production;
- Decoupling integration into the agri-food markets from subsidies;
- Decoupling qualitative and safe food production from environmental degradation;
- Decoupling bio-energy production from environmental harm.

Strategic elements — i.e. technology and decoupling — are considered as key drivers for steering changes in the EU agricultural sector that are capable of reaching the AG2020 targets within different decision environments (Giaoutzi and Stratigea, 2007b; Giaoutzi et al., 2007c).

Images of the Future

The Images of the Future in AG2020 are built as different combinations of contextual elements (as previously presented) and strategic elements, i.e. different assumptions about changes in technology and decoupling between the present and the future (2020). On that basis, nine different combinations of contextual and strategic elements are considered in AG2020, leading, respectively, to nine possible Images of the Future (see Table 3 below).

The Images were evaluated in terms of their coherence, plausibility and performance in respect to the AG2020 set of objectives. Out of this process, three Images were considered to be the most prevalent. These represent, as clearly as possible, different settings and futures of agricultural development in Europe for the year 2020. These are (Giaoutzi et al., 2008b):

- *Image T1:* 'High-tech Europe: Global Cooperation for Sustainable Agriculture', where science and technology are of the utmost importance, together with a focus on 'top-down' initiatives (Image I).
- *Image TD2:* 'In search of Balance: Accord on Sustainability', where a 'combined approach' is adopted, incorporating 'medium' technology and 'medium' decoupling dimensions, while the focus is on economy and energy (Image II).
- *Image D3:* 'Active Regions and Reflexive Lifestyles', with a strong decoupling dimension and a 'bottom-up' approach. Here the emphasis is placed on behavioural change, which involves strong public participation (Image III).

Table 3: Images of the Future in AG2020 as different combinations of contextual and strategic elements
Source: Giaoutzi et al.(2008b)

		Strategic elements		
		Technology +++ Decoupling +	Technology ++ Decoupling ++	Technology + Decoupling +++
Contextual elements	Top-down	T1	TD1	D1
	Combined	T2	TD2	D2
	Bottom-up	T3	TD3	D3

The images were designed, developed and refined in cooperation with 'expert groups' in an iterative process. In these images, the desired futures are described by the most important socio-economic, technological and environmental developments and the most important key-drivers.

Key elements and key states
In order to structure the policy framework (policy measures, packages and paths) that will support the transition of the study system from the present situation to Images of the Future, there is a need to define *key elements*, as important policy areas between the present and 2020 and *key states* as the level of change needed and the intermediate steps between the present and the Images. The key elements considered in AG2020 are presented in Table 4 below.

Table 4: Key elements (areas of change) in AG2020
Source: Giaoutzi and Stratigea (2010)

Key Elements	Bio-economy
	Regulated agricultural factor markets
	Rural development
	Integration into agri-food markets
	Energy production
	Food quality and safety
	CAP 1st pillar
	CAP 2nd pillar

The level of change needed in each of the above elements (key states) is explored, which then guides the next step, i.e. the development of the policy framework for bridging the gap between the baseline scenario and the AG2020 Images of the Future.

Policy measures, packages, and paths
At this stage, a pool of 257 *policy measures* affecting key elements (areas of change) is constructed. These fall in the following four broad policy directions (see Giaoutzi and Stratigea, 2010):

- *Lifestyle-oriented policy measures*: policy interventions that support the shift towards more high-quality lifestyles.
- *Market-oriented policy measures*: policy interventions that support a market system that promotes best environmental practices, by shedding light on the linkages between environmental sustainability, economic profitability and competitiveness.
- *Regulation-oriented policy measures*: policy intervention that rely upon technical standards and norms (e.g. pesticides upper limits, traceability, GMO allowance), innovative planning approaches (e.g. spatial planning, land-use planning, etc.) and governmental reform.
- *Public infrastructure/services-oriented policy measures*: policy interventions that relate to the provision by the state of infrastructure and services to rural regions, e.g. transport and telecommunication networks, irrigation infrastructure, training infrastructure, etc.

On the basis of the methodological approach presented in Section 3, fifteen *policy packages* have been built (PPs), each of which is designed to address a specific dimension of the Images of the Future. Each package consists of a certain number of policy measures. These are used for building three distinct policy paths, each of which can drive developments from the present situation to a specific Image of the Future. Figure 4 presents the outcome of the AG2020 backcasting policy scenario approach (Giaoutzi and Stratigea, 2010), where each policy-scenario is represented by a specific Image of the Future and the respective path to reach this future.

5. Conclusions

Dealing with future developments is a rather intriguing issue for planners due to the uncertainty and complexity involved in the globalized society. Planners, in their efforts to support decision makers in long-term planning studies, are being challenged to develop new tools that are capable of grasping and assessing the range of future options available. Along these lines, the backcasting policy-scenario methodology developed in AG2020 represents a useful innovative approach for building strategic policy scenarios. On the basis of the experience gained by its application in the context of AG2020 for building backcasting policy scenarios in EU agriculture in 2020, the following general remarks can be made:

- The approach is characterized by a creative approach which, through a number of iterative steps, can provide a deeper insight into the problem concerned and suggest a number of very interesting policy options, which might be of importance for future developments, rather than proposing precise policy directions for different external conditions.

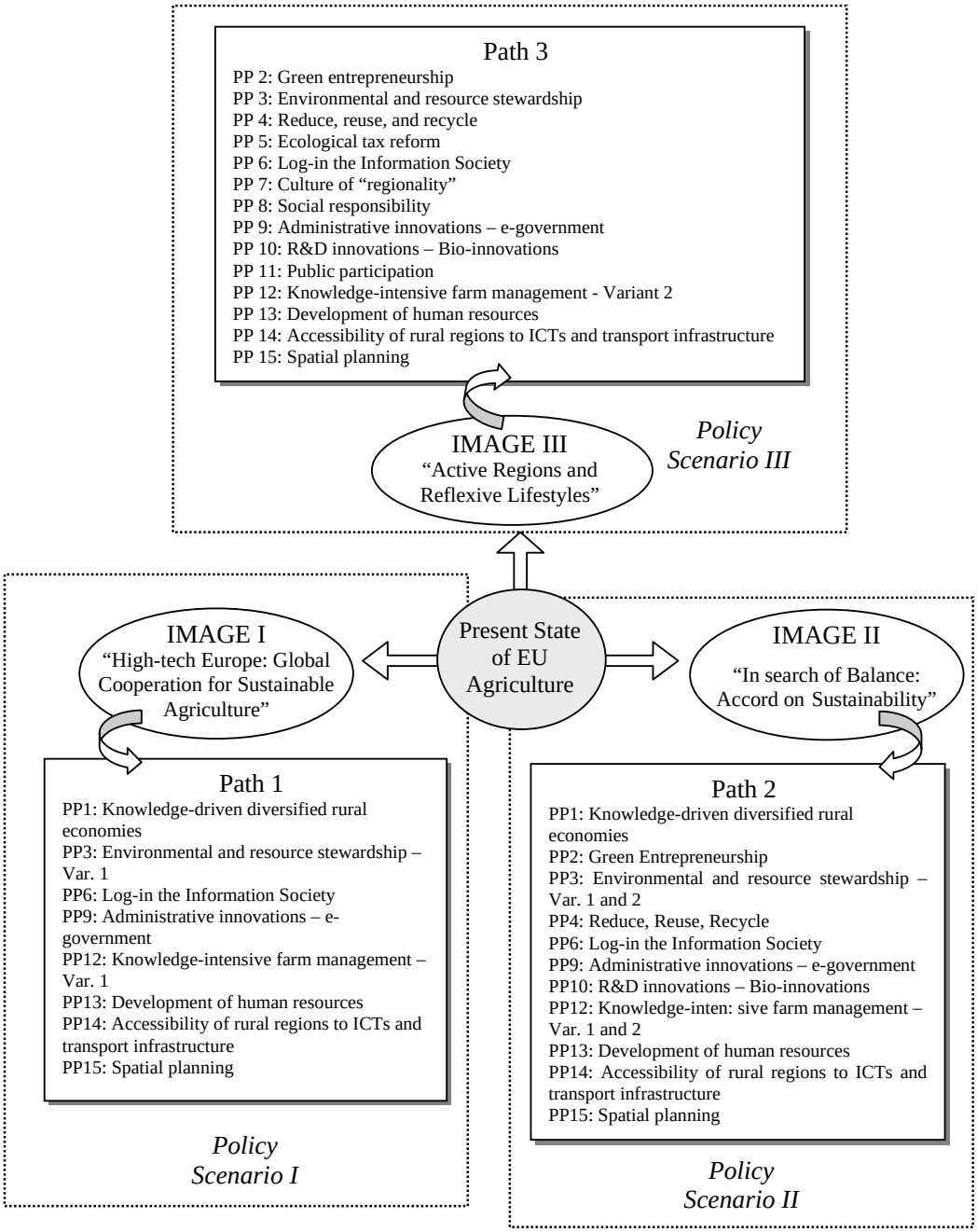

Figure 4: Backcasting policy scenarios in AG2020
Source: Giaoutzi and Stratigea, 2010.

- Of importance is the focus of the approach on building backcasting policy scenarios (images and respective policy paths) that represent distinct possible alternatives, rather than single policy options.
- Participatory approaches are quite important in this respect, both as communicative tools for increasing awareness of prospects and risks in the agricultural sector and as consensus-building tools for better implementation of policy decisions.

- This approach supports decision makers in the assessment of the impact of policy decisions, by providing for each policy measure the scale of impact on targets (small, medium, and strong effect) and the timeline of this impact (short, medium, long-term), which are of importance at the implementation and monitoring stage.
- It provides a set of policy options (packages and paths) that might be useful to prepare policy decisions under a range of external conditions rather than under a specific set of conditions.
- It provides information on the level of change required (the gap between baseline and desired outcomes), which is useful for problem identification and prioritization, increasing the awareness of stakeholders and the public, prioritization of policy interventions, etc.

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